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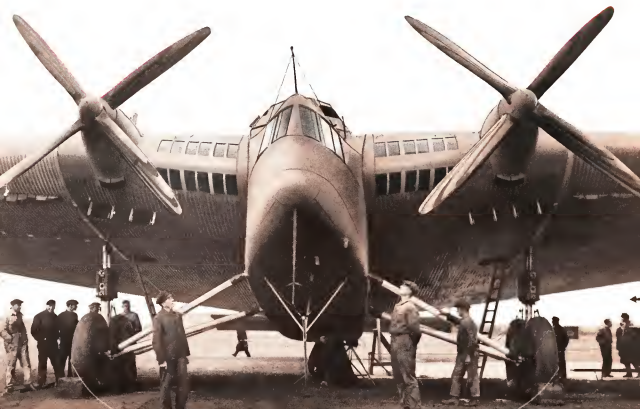
AVIATION

The Oldest American Aeronautical Magazine

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If any evidence were needed that aviation had changed from a hazardous adventure to a world industry of vast importance it is furnished by the Consolidated Commodore.

These pure aluminum air lines, with a wing speed of 100 feet, and a carrying capacity of 25 passengers and thousands of pounds of air mail, operate safely and regularly along an 8000 mile coast—spanning the distance between New York City and Buenos Aires in seven days.

Designers of planes capable of accomplishing such vast transportation enterprises now turn inevitably to Aluminum and its alloys, as the one material that will serve their purpose.

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—a protection against corrosion known as the ALCLAD process.

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The new 7-place Lockheed Vega is listed at \$18,900.
Complete information will gladly be sent upon request.



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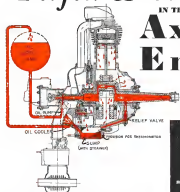
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The lubricating oil passes from the supply tank through the pressure pump, on the rear of the engine, entering the hollow crankshaft. The passages for the oil are integral with the crankcase. The oil leaves the crankshaft at the front main bearing, passing through the pressure relief valve, which is built into the front crankcase section. From the relief valve, the oil enters the oil sump, where it is passed through a double mesh oil screen. It then leaves the oil sump via a short external line of ample diameter—the only external line of the entire system—passing through the scavenging pump into the oil cooler. The temperature of the oil is there modified to the best operating point, the excess heat being transmitted to the intake mixture. The scavenging pump adjusts the oil cooler and is connected directly thereto without any piping. The cycle is completed by a connection from the



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(213) 4-8011

AXELSON AIRPLANE ENGINES



oil cooler back to the supply tank. In addition to the front oil breather, there are two breathers located in the central crankcase section, thus assuring proper crankcase ventilation. Provision is made in the oil sump for inserting a thermometer.

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Length overall—39 ft. 11 in.

Wing span—31 ft. 7 in.

Span between wings—30 ft.

Ground turn radius—45 ft.

Wing area—333 sq. ft.

Weight empty—1200 lbs.

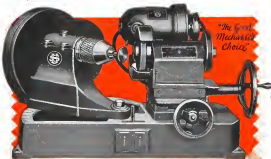
Best climb—300 ft.

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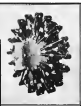
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New only in name . . . "Wasp Junior" combines expert engineering with the experience gained in millions of miles of flying.

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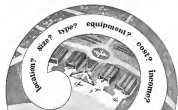
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Detailed information relative to the International Aircraft Exposition can be had by addressing the Aeronautical Chamber of Commerce, 10 E. 40th St., New York City.

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Daily service from Miami to Havana has grown from one airline to seven each day. Tri-weekly service to Mexico has become daily. Daily service (except Sunday) has been established throughout the West Indies—Havana, Santiago, Haiti, Santo Domingo, Porto Rico—with weekly service from San Juan to the Windward, Leeward, and

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Type MSA1

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AVIATION

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Accident Causes in the Spotlight

THE SENATE of the United States having recently directed that the results of the official inquiry into the cause of the fatal crash of a passenger airplane on the side of a New Mexico mountain two months ago should be made public, the Department of Commerce has had no alternative save to comply. Material that has always heretofore been held secretly confidential must be spread upon the record. A precedent has been created and inevitably there will be repeated attempts to secure the same public exposure of the results of the Department's inquiries in other cases. The decision runs with Congress, which has full and undisputed power in the matter. It is a decision fraught with great significance for the aircraft industry, and the industry cannot be indifferent to the course followed. From the point of view of aeronautical development both secret and publicity have their advantages, and we have balanced them against each other long and carefully before arriving at a conviction of our own as to what would be the wisest policy.

Nothing does more to inspire public confidence than a frank telling of the facts. Let the nation get ahead that there is something sinister about airplane accidents, or that the industry dotes not sound faith to tell the truth to the whole world, and the most progressive remedy will be shown. We could not, if we would, prevent public knowledge of the fact that an accident has happened. There is too much to be said for making it known just how it happened and why, and especially for seeing the lessons to point out just what is being done to ensure that lightning will not strike a second time on the second plane.

Furthermore, publicity serves the industry in good for the industry itself. The lessons of a transport accident

are not confined to the company that suffers it. To point a detailed analysis is to resolve it less likely that anyone else will suffer a similar misfortune. The work of such organizations as the National Safety Council is based largely upon the application of hindsight, pointing home the lessons of the accident that should have been avoided. The operators of aircraft can learn to improve their safety record in the same school.

There is one side of the shield. We have tried to present it fairly. The arguments for publicity are against ours. But there is another side.

The first initiative for the revelation of hazards lies with the Department of Commerce. It is of the first importance that the Department should be able to get all the facts and get them accurately. They must be secured as a basis for possible modifications in the Department's regulations and methods. They serve also as the raw material of those general surveys and classifications of accident causes that are periodically prepared, and that are of even more value as a guide to operators than separate studies of individual crashes could be.

It is of the first importance that the Department should get all the facts, but often it cannot be done if publicity is known to impend. The most pertinent information concerning an airplane crash is often possessed by but one or two people. If they are told in complete confidence, they will almost always speak frankly. If they have to feel that they are talking for the newspapers they will be very cautious about saying what they may think but may not positively know, and they would be less than human if they did not seek to adorn the epitaphs of testimony regarding blame or incompetence to individuals who may have lost their own lives in the crash. The expert corps of those who work in aeronautics in

strong, and largely so. They never display any eagerness to close the door of an accident by the simple expedient of finding a dead suspect.

Likewise, the Department itself often has to speculate in its report, for lack of positive information. Where the sole object is to extract information useful in avoiding a recurrence of the accident, it is quite permissible that the pilot be filled in by as much guessing as necessary. In a report designed to become a public record, such a course would be unacceptable.

On the whole, we believe that for the present the Department's policy of secrecy is wisest and should be left unaltered. We believe that the trend will be toward more publicity, gradually obtained by making the periodic accident reports increasingly specific, and by including detailed analyses of certain accidents of special technical interest but denoting them by symbols and preserving as much anonymity as practicable. Five years hence it may be advisable to make public as full an official report upon each transport airplane crash as is now made in a redacted accident. We doubt even that, but in any case we are quite sure the time is not yet.

At last one thing is perfectly clear. Whether there be full publicity, no publicity or partial publicity, the named in the individual case should be by the Department of Commerce, not by spontaneous sentimentality. Already public report has been rendered upon one disaster (that of the New Mexico one) which had no technical features of special importance, for an ignorant person might get that a member of Congress was personally interested and made his interest valid. The decision in the individual case, if there is not to be complete anonymity of treatment, must depend upon the facts of the accident itself, not upon the political pull, or the personal friendship with a Congressman, of someone who has either a personal grievance or a glaring design set against the owner of the plane involved. That point is serious. It is serious enough to deserve the attention of the senior Congressional leaders who can prevent the routing through of most resolutions for publicity or for renewed investigations.

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Why the Highways?

THIS YEAR saw the motor-car owners of New York State tired of paying gasoline taxes for the support of highways, turn into little less and successfully overthrow the patently ridiculous assessment.

Airplane operators of many states are paying the same airport excise and funds which are obviously needed to round out our aviation program are being devoted to unnecessary uses in connection with highway development and maintenance. Gladly we note signs of protest and movement.

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We do not feel like placing the onus entirely upon the state legislatures. When such crises were presented for by crime, few people ever thought that gasoline and flight would ever have the intimate relationship. In fact, they didn't believe in flight at all, and were even out toward the automobile. It may safely be assumed in most cases that the only reason plane owners in most states are paying gasoline taxes is because no one has translated the legislation of the aviation and for an amendment to its particular ten states.

In one state which provides more than its quota of gasoline and a fair share of planes to consume it, the licensing bodies are essential of every effort to shut the aviation industry of the unnecessary burden. This is undoubtedly because they feel that the plane is not a part of the state's economic picture, but an instrument of recreation and amusement. As a matter of fact, this particular state probably benefits as much from the use of airplanes as any in the Union.

As an alternative, and entering for the sake of an opportunity to show the other side of the situation that some feel tax may be rightly expected of airplane owners, why not direct such income to the development of intermediate landing fields? Why not the state themselves assume some of the burden now so ably borne by the Federal Government? Certainly they may expect the cooperation of Washington to such an end, and with the problem of financing the present project solved by the assistance of an income it is not unreasonable to anticipate a very great deal of good advancement naturally to the convenience and the aviation industry.

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Marking Blankville

ANKLEND correspondent reports growing popularity for a new form of lawn service. Pairing the nose of the town in magnificent yellow letters on the most conspicuous available roof has become a favorite pastime. Young and old, able and infirm, men and women, they have all used hammers and buckets of chrome-yellow liquid and started to glowing letters.

We can only hope that the report is true. It seems almost too good to believe. Elong long deferred has made the cross-country pilot's heart sick. Eleven years have passed since the aviation. Non-aviation voyagers by air have been a commonplace during two-thirds of that time. The American Legion, the Exchange Club, the Guggenheim Fund, and Chambers of Commerce without number have stood behind campaigns for the promotion of universal air-traveling. Yet even now the traveler by air realizes to his sorrow that the term that is marked is extraordinary, a shining exception among its fellows, and any definite and vigorous action, such as is now favored

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to be manifesting itself in the six southeastern states, it still a new day's wonder.

There are some parts of the country where air-traveling is practically unknown. There are some where it is much more than figmentary, as when and for further effort is lacking, although some districts, notably California and New England, show largely by contrast with their less energetic neighbors.

In most cases there is no direct advantage, nor possibly, a little temporary publicity, to be gained from shortening the connection for the air pilot. The effort is one of almost pure altruism, but unless commercialized, and not merely a few here and there but hundreds or thousands of these cross-country flying can never be as simple as it should be especially for the smelter of limited navigational knowledge.

If the immediate return is small, so also is the cost and the difficulty of the work. All that is needed is a little enthusiasm. Attempts to promote it on an national scale through national organizations have met with only a limited success. They must be supplemented by local pressure from those who are kindly and personally interested.

No chapter of the National Aeronautics Association should rest easy as long as there is an unmarked town within fifty miles of its headquarters. No chamber of commerce that has an aviation committee, and most of them have, now, should fail to assume the responsibility both for getting its own town marked and for working upon less progressive neighbors.

Competition would of course solve the problem. It may even prove to be necessary, and at least one legislature has already flirted with the idea of imposing upon each town or city government the definite obligation of identifying itself forthwith. The possibility of employing such a legal club is one to bear in mind. We will hope, however, that civic pride, properly stimulated, may suffice. To eliminate it is a task, and should be a welcome one, for those actively interested in aeronautics. If all of us who are so interested take the matter seriously we should have early and frequent occasion to repeat progress.

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International Boundaries and Commercial Aviation

ANALOGICALLY, the nature of aviation is designed to whittle away the speed of air transport is to be available in usefulness. To entangle international flying is a case of time-wasting red tape to remove the means for its existence.

In a general way, the truth of these true observations is recognized. Periodic efforts have been made to simplify the procedure of customs examination of less

gracious inspection, and in general all of that rates of formality that traditionally attend the transfer of passengers and goods from one national sovereignty to another.

We certainly have no wish to belittle what has already been accomplished by the efforts of the Treasury Department and the Department of Commerce, working with what co-operation other countries have felt disposed to offer, but more is needed. We are encouraged to note, as representing not a final action but a symptom of increasing interest, that aeronautical procedure has engaged the special attention of the (take a deep breath before saying it) Pan-American Commission on Customs Procedure and Port Facilities, just adjourned in Washington.

The rules developed through centuries of experience with merchant shipping barely offer a starting point. A west of a few hours in quarantine at the end of a three-thousand-mile ocean voyage is annoying but not a disaster. A delay of a few minutes in completing an aerial trip is much more feverishly resented by passengers who have paid liberally for extra-rapid travel, and their resentment is likely to be visited upon the transport line.

Smuggling by airplane cannot be overlooked. It has unfortunately been rarely prevented. Measures have to be taken to check it, but they ought not to involve detaining any air line passenger more than ten minutes from the instant where his plane takes up in the destination platform until he is free to go where he will and take his baggage with him. European governments have generally opened up their borders at least to that extent. We ought to be able to do better in the western hemisphere—but we shall never do it by taking the rule-book for the official reception of ocean liners and going through it from A to Z.

It is not exclusively or especially in our own government that these remedies are addressed. Our travelers are even more seriously affected by the rules in force in the foreign lands that they visit. Nor is it only in connection with the regular transport lines that the subject is important. They have been able in some cases to make special simplifying arrangements with governmental authorities and to minimize delays by gaining the personal confidence and the co-operation of officials. Of almost equal concern is the status of the flying traveler by air. Experience upon the Graf Zeppelin's first aerial visit to the United States a year ago afforded a brilliant example of the misapprehension when a differential allowance to an inflexible routine is superposed on an unending underestimation or persecution by those responsible for an aircraft's operation. To avoid future difficulties there should be constant attention, for some time to come, to the development of improved procedure and the issuance of specific instructions for dealing with friction and delay, not only with regular aeronautical operations but with aeronautical emergencies.

LOOKING AHEAD IN *Airport*



Fig. 1. Experimentation between land at the Cleveland Municipal Airport. In addition to the several provisions to directed and shielded to provide a solid array of light through the more 100 degree illumination in exposure air or projection has been provided. These are said with red over others as that on the former instance, is obviously unique a path of red and blue white light through the sky.

WILL THIS lighting system meet the Department of Commerce requirements for an "A" rating? That seems to be the question of primary concern to airport managers in discussing or in planning airport lighting facilities. The managers of existing airports and private aircraft owners, however, for whose use the facilities are provided, should have a somewhat different criterion for judging lighting provisions.

The viewpoint of the municipal airport manager can be justified from the fact that municipalities, suitably projected into the business of airport administration, with the inevitable requirements of local assets for land, grading, sewers, buildings, etc., find the element of cost a very important one. This has been a considerable factor in limiting demands lighting practice because the result has been to provide the least necessities as far as lighting is concerned. These provisions have appar-

Lighting Development

ently taken care of the relatively few, right place, provisions, coupled with the fact that most of the pilots doing right flying were experienced and extremely successful.

THE expediency of aviation in meeting public needs will depend more and more upon right flying as a matter of course. Lighting, therefore, is of prime importance to the success of the industry. It is significant that lighting is one of the three major aspects in which an airport obtains a rating from the Department of Commerce, yet the standards set up are in the nature of minimum requirements and as such are made properly to be worked from rather than in. While minimum standards are necessary, their effectiveness must to least progress, particularly as an competitive bids and awards are usually based on minimum standards and lower costs.

While the general requirements of lighting for night flying are fairly well understood and developments in lamps and equipments to meet these requirements have been made, it cannot be considered that the solution of the problem is of all standardized. The present practice in airport lighting has grown out of the necessity for providing some sort of illumination largely for the service of the air mail. As flying becomes more general, new standards will be desirable for the convenience and general sense of security and well-being which the public quickly learns to expect. Airport lighting will effec-



Fig. 2. Relationship between actual and theoretical light intensity as a function of distance. The graph, for the first instance, is that of some of maximum projected conditions.

in no small way the general acceptance of night flying. From the standpoint of the aircraft operator, obviously, minimum standards are inadequate. His concern is in the maximum of safety, general utility, and expediency of traffic operations that the best system can provide. In his business as in all other business the advertising value of light will be a factor in the provision of his service. To insure confidence and build up patronage for air travel, no factor is more important than adequate airport lighting.

The cost of the best lighting system is small, compared to its service in extending the use of an airport through out 24 hours a day. Furthermore, a single serious accident—made worse the danger to human life—due to inadequate lighting might involve more expense than the entire cost of the best lighting facilities.

THIS may come, with the development and perfection of acoustic instruments, when aircraft may be operated without demands for their seeing outside of the cockpit or control room. At the present time, however, it seems only sensible to provide the best system of illumination that it is possible to devise. Improvement

By C. E. WIETZ

A Discussion of Lighting Conditions and Problems as They Exist Today and the Improvements Necessary to Future Development

Lighting economies. Industries today are employing ten to twenty times as much light as they considered necessary a few years ago. Although they were able to operate with a lesser amount of light, they have found that the decrease in accidents, lower spoilage, and increased production offset many times over the additional cost of more light.

Take conductance of light. That is nearly comparable in the subject of airport lighting. A few years ago, the practicability of lighting up large indoor areas for night sports—football, horse racing, golf, and the like, was seriously questioned. We have grown up with the impact to be met with light.

Last June there was a contest at a Toledo race track about 180 low to light the track. This corresponded roughly to 6 foot-candles of illumination over the entire mile course. The drivers did not want to risk injury to



Night view of Cleveland Municipal Airport with one 100-foot-wide floodlight beam.

The aviation industry in its lighting provisions can well profit from the experience of other industries and other commercial persons in their attitude toward light and

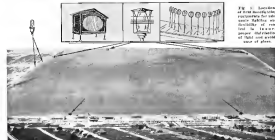
their high priced horses under a lower standard of illumination. In order to meet airport lighting regulations for an A rating at least 0.15 of a foot-candle must be provided over the landing field. Only one-fourth as much light for the safety to life and property of the aircraft operator as was provided for success and safety of horses running doesn't seem to be a very reasonable or satisfactory condition.

Hors, then, and everywhere are spreading up practice golf courses of 10 to 15 acres, lighted after a fashion that would delight any pilot as an oasis of light in a desert of darkness. Baseball games have been played at night. This year many football fields are being lighted for night play. As this is being written, a local college decided on



Various lighting units have been developed to meet the needs of the airport. Searchlights, floodlights, and other types of light fixtures are used for different purposes. The diagram shows the various types of lighting units used for different purposes.

Monday to light their field for a game the following Friday night. Forty-eight kilowatts of lighting are being used. Other conditions being suitable, a pilot could set his place down on the 50-yard line and really see what he was doing. Even this modest installation should get an A-10 rating if graded on the basis of visual conditions. And far too many airports are expensive time foodstuffs. In this case, the airport, from which there is much scheduled night flying, 20 feet or less of lighting is doing



very as the lighting system for an active area at least ten times as large.

One interesting example of the use of light in other industries was the filming of the movie "Roundup" which employed over 6,000 lb. of electrical energy for lighting the set. This roughly was more wattage than was being used in the lighting of all the 10,000 acres of lighted airports, and in the lighting of all the airports in the United States at the time of release of the film early this year. More light for a single movie production than was provided for the safety and progress of air transportation over the 40-500 miles of day and night flying on established air routes!

This is not an indictment of the aviation industry on the count of negligence in lighting matters. It is offered only as a suggestion to be aimed toward the use of light, and to look forward to improved methods that are certain to be more effective. It also implies that light, properly informed as regards glow, as a partnership with the eye as far as vision is concerned and as we control light in quantity and distribution to the same extent do we control vision and how well we see.

THE AVIATION INDUSTRY has had one problem at the doorstep of the lighting engineer. While the experienced engineer may understand the principles of light protection, light control and light utilization, and understand fully the relation between light and vision, he must necessarily meet any limitations or restrictions imposed by solvent requirements of the new service. At the same time, his recommendations must be practical and in keeping with administrative and financial conditions.

In meeting aviation lighting requirements new lamps and new auxiliary devices and equipment have been developed. The art of light protection has been advanced. Modern high-powered light sources combined with refinement in design of projector equipment caught the popular fancy by virtue of the extremely high values of candlepower to which the new devices were rated. Unfortunately, these extraordinary figures apply to the legume unimproved illumination results.

The Airport Rating Regulations on lighting define the

Fig. 1. Location of first searchlight equipment for the various lighting and visibility of the airport. Fig. 2. Location of second searchlight equipment for the various lighting and visibility of the airport.



Searchlights search for an air traffic plane of photograph and taking mid-airplane distribution data on an airport lighting installation. They are used for the same purpose as the searchlights shown in the diagram.

various elements essential to aviation service. They specify minimum allowable values as regards safety and reliability of operation with minimum limiting values as regards results. They are no way restrict or hamper development and application of improved devices or methods. The effectiveness of an airport system depends upon several factors:

1. High candlepower for long range visibility;
2. Visibility from all natural flying heights;
3. Suitable direction of flash period;
4. Pseudo identification.

In order to effect the greatest range of visibility, the beacon must develop a beam of extremely high candlepower. In practice, however, the relation between candlepower of a light source and visibility distance is dependent largely on atmospheric conditions.

If the beam is confined to a 3 to 5 deg. spread in an endeavor to obtain maximum human candlepower, the effectiveness of the beam is reduced because a plane at ordinary flying heights will benefit only for the short time it may be in the main beam. The latest U. S. Department of Commerce design specifications for airport beacons recognize this point in providing for a 25 deg. fan of light above the main beam. In addition four cylindrical lenses are provided in the upper part of the housing, which emit some light so that the beacon is visible from any position overhead. Any redistribution of light from a projector is, however, accompanied by a sacrifice of beam candlepower of the main beam.

A third factor enters into the problem in connection with the present aviation beacons. That is, the question of flash period. The standard beacons have a beam speed of about 5 deg. and rotate six times a minute. This does not allow the light to fall on the pilot's eye for a sufficiently long period of time to permit the eye to reach its maximum response. If the present rotating beacon is stopped in its rotation with the beam striking directly toward an observer the beacon appears to become much larger and more brilliant. A greater beam speed would therefore produce a more effective beacon.

Slower flash period can be obtained in two ways, either by lowering the speed of rotation or by spreading out the beam. The former is not desirable because this has six flashes per minute allows a pilot to travel too far between flashes. Great increase in spread of the beam means loss in beam candlepower. Perhaps it may prove desirable to spread the beam somewhat and maintain present maximum candlepower by using a somewhat

higher wattage lamp than the present standard, or by using several lamps and several projector equipments each of which is designed to add its light distribution for the best effect of the beam as a whole.

The latter possibility has led to the consideration of a multi-light projector as shown in Fig. 1. Two long range projectors are provided with their beams aimed to increase the effective beam spread without the loss of candlepower. In addition, auxiliary projectors are provided of much lower characteristics in order to create a vertical fan of light of relatively high candlepower visible from any location in the upper horizon.

The use of colored beacons, particularly red, was first advocated because of the general impression concerning the ability of red light to penetrate fog.

The higher visibility of white light beacons required by the Bureau of Standards (maximum candlepower) even during bad weather dictates their being retained although it is recommended that they be supplemented by colored projectors for positive identification and guidance. The night air map of a city is nothing more than a aerial all light—search lights, lighted buildings, signs, and flashes from automobile headlights, particularly where the streets and thoroughfares are yellow. Because of this, white light beacons do not attract attention to themselves and are not picked up as quickly as are colored beacons which contrast with the lights of the city. It is felt therefore that the airport beacons should provide both clear and colored beams of high candlepower—the first for the greatest visibility under adverse conditions, the latter for quick and positive identification of the airport location. Where two or more airports are in close proximity each airport might be assigned a particular identifying color.

FAIRER AGREEMENTS in the design of boundary aids are being introduced which show distinct advantages over the early slender steel rods from the standpoint of daytime visibility and the clearance of certain hazards in event of collision. Early practice called for the spacing of boundary lights from 500 to 100 ft. The opinion was generally prevalent, at that stage of this order, that they were not great to give the best results. This is particularly true of airports located adjacent to streets or highways paralleling the boundaries of the field and because of the direct spacing of strong lighting towers it may be difficult to identify the weather more widely spaced boundary light sources. Furthermore, a pilot passing over the corner of the field may have difficulty recognizing this as a cor-

nor, this is particularly true under adverse weather conditions when the sun is spaced at considerable distances. If boundary lighting units are spaced from 75 to 125 ft apart a pilot flying over any corner of the field will under adverse conditions of visibility be able to see a sufficient number of the boundary lights to assure his position with respect to the field boundaries.

The simplest specification for lighting landing fields related to the fundamentals applied to other general lighting problems, can be stated in terms of lumens of light, or foot-candles, delivered per square foot of area. This is prefaced on the generally accepted fact that the best observation system for landing, taking off and general operations provides practically uniform distribution of light over the entire area.

A combination of circumstances has made it seem desirable to install field floodlighting only only 10 ft, or so above the ground, and to attempt to sweep the landing area with a fan fan of light. With such a wide angle of projection, the zone of maximum candlepower must be aimed only the slightest amount below the horizontal plane in order to project light to the far boundaries of the field. Under these conditions of projection, the lower half of the beam falls on the field, while the upper half is lost. As far as lighting the ground is concerned, with a narrow vertical spread and a sharp cutoff, this upper part of the beam projects in effect a layer of light above the field projected nearly parallel with the ground. When the atmosphere is unusually clear of dust or moisture particles, this upward light may produce a blanket of light sufficient to obscure the ground. In fact, some pilots have learned to gauge their height above the ground by the depth of the beam. On the other hand, if more light can be directed toward the ground and if the landing surface is light in color, the surface brightness will be high enough to overcome the apparent ground haze and allow the ground to be seen through the haze. This would appear to dictate a higher mounting of projectors and perhaps a modified beam pattern in order that the light might be directed more efficiently toward the ground.

With the present practice of low mounting of field floodlighting, regarding the ratio between vertical and horizontal illumination is very varied. Fig. 2 illustrates some illumination measurements taken at 200 ft and at 200 ft from a 24 kw 180 deg arc lamp flood light developing slightly over 2,000 foot-candles beam candlepower. It will be noted that at 200 ft the vertical illumination is well over 0.15 foot-candles minimum required by the Department of Commerce but the horizontal illumination is at the order of 0.006 foot-candles or only about one-fifth of the vertical.

At 300 ft the vertical illumination was of the order of 25 foot-candles while the horizontal foot-candles fell to 0.07 foot-candles. The ground in the immediate vicinity of the projectors appears fairly well lighted and favorable for landing with the beam since the pilot has the advantage of absence of glare, relatively high ground illumination at the point where he wants the vehicle and has the further advantages of high vertical lighting on grass, tarmac, or weeds, that indicate the field boundaries ahead.

On the other hand, if he is faced to approach from the far side of the field toward the taxi, the beam from the floodlighting is almost negligible (the result of 0.006 foot-candles is only about half what one could expect from full moonlight), so that the ground conditions are quite obscure; furthermore, he cannot benefit by the vertical

illumination since he is on the dark side of all such obstacles.

Shadows caused by irregularities in terrain or weeds become particularly objectionable, for they are apt to give the pilot a false impression of the condition of the landing area. Small knobs casting deep shadows make the beam to appear as deep holes or valleys.

These facts should consciously point to the futility of trying to light an area as large as an airport landing field adequately with one high-powered projector or battery of projectors; nor is it any more expedient to provide a number of projectors anatomically located unless provided to deliver adequate light volume comparable to the area to be lighted.

BETWEEN the absolute necessity of providing light as clear as possible, the single high-powered source has been preferred to the system using lower powered sources distributed at many points around the field boundaries. When such single units are located with respect to prevailing wind direction, the pilot is free from glare the greater portion of the time since headwinds may be made over the area and in the same direction as the projected beam.

Lighting engineers have for some time felt that the most flexible, safest, and most desirable system will require one, preferably two, high-powered units located on opposite sides of the field. Such a system is illustrated in Fig. 3.

Provision should be made for at least 200 kw. of electrical energy for field floodlighting purposes. It is reasonable to estimate requirements to this extent, not alone because maximum safety will be dependent on the use of more lights, but mostly for psychological reasons in that the well-lighted fields will go a long way to increase public confidence in the practicability of night flying operations.

With such a system, so installed that each unit is controlled individually from a single control panel, the existing wind direction would dictate the particular units that would be lighted as that landing and taking off would always be made in the direction of projected light; subsequently, glare would cease to be a serious matter. Two, three, or even four, units in the rear and right side might be used simultaneously, thus regulating the amount of light as required for any occasion, or for adverse conditions of visibility. Furthermore, the use of several sources—single beam because of their location—produces a cross-direction of light, greater uniformity of distribution, and eliminates beam shadows cast by the plane, itself, or caused by rolling or wavy terrain.

Systems of this sort, where they have been installed, have proven most satisfactory and deserve serious consideration on all airport projects.

The matter of cost has been a deterrent to the full provision for adequate lighting facilities. Naturally, monetary budgets are not particularly elastic. Initial expense incident to the establishment of an airport has in most, by necessity, been limited. Also, the expense for lighting is not lessened the more limited the appropriations for lighting. This is spite of the fact that no one doubts that the success and value of an airport depends to a large measure on its lighting facilities. It is natural that we may expect lower costs on equipment in the demand increases and power unit volume is obtained. Also, the reduction in cost of airport lighting equipment have taken place. Furthermore, as time goes on it is reasonable to expect that the cost of airport operations will decrease with the increase in air traffic.

WHAT PRICE Merger?

By TALBOT O. FREEMAN

Assistant to the President, The Aviation Corporation



THE DEVELOPMENT of aviation has suddenly reached the merger phase of the cycle. I say suddenly, because other comparable industries have taken decades to run the gamut of several cycle phases which aviation has sped through in but a couple of years. Some have even claimed that aviation's merger stage has been entirely artificially induced, and that its appearance at this time is out of place and premature; that, in fact, it is solely the child of the whims of certain powerful leaders in the industry who believe they can meet the threat of the small competitor through sheer size and wealth of resources. This absurd rumor is wholly unfounded. If anything, the great leaders have tried to induce a period of sane reasoning, which would allow aviation to proceed toward a stable and prosperous future on a firm foundation of assured public demand.

In fact, aviation has reached the merger stage at this early period in its commercial history because the present great prosperity of America has produced an unusually large number of super-optimists who have been all too ready to risk their money on a pioneering venture. In this way there has been provided an unusually large amount of capital which has produced a consciousness amongst of unaccustomed feelings, having not only no definite relation to the rest of the industry, but being even greater in capacity than the present traffic will bear. At any rate, aviation is now going through the merger phase because it needs the benefits of this expansion.

When the merger stage began, one heard everywhere: "That way should we merge with anyone? What advantage will we gain thereby that we cannot provide for ourselves without relinquishing our independence?" It is the purpose of this article to answer just these questions.

First of all, the early organizers of airlines companies were, by necessity, chiefly promoters. One was an ex-World War flyer who could not forget his first love. Another was a mathematical or mechanical genius who had invented a new wing curve or a new type of engine. A third, or financial type, saw the opportunity to make some real money on Government contracts. Still another, who knew at about some other business was intrigued with the possibilities of this newest industry about which he knew less than nothing and so on an individual. As a result, precisely all companies to date

have one trait in common, i.e., they lack sound management. One company has made big money in aviation for years, yet today it has no engineering department worthy of the name. Another has hardly a semblance of real production methods in its shop. The cost accounting system of a third amounts to subtracting the year's expenditures from the receipts, and dividing by the number of planes sold. Not only that, but the whole industry is an almost total ignorance of scientific market analysis. I am speaking now, of course, principally of the smaller independent companies.

AFTER ALL THIS, then, merger of the right sort means the acquisition of capable management. Watching the automotive production race, the machine tool expert, the cost accountant, the marketing specialist, and the well-traveled engineer standing in line to buy dollars for the big aviation sale, brings a great sea of warm goose bumps pouring through a rift in the clouds after the storm. And, mind you, it is pressure from wise, experienced bankers which has forced into the large banking companies capable executives who recognize lack of fundamentals when they meet it—either in a plant or on a line. Furthermore they know where to go to get the men they need to correct the shortcomings.

The promoter has filed a most useful purpose, for only he would have had the vision and belief to seek to the day during the pioneering era. Now, however, he must get himself a partner or partners, for the competition is too keen for him to survive without the last word in modern methods. Some men who have the pioneering spirit become good capitalists as well, but only after long years of struggle and learning in good, experienced hands. Those in the industry who are full of zeal and do not know when they are to turn, cannot be argued so strongly to seek a helping hand without delay. Unfortunately, however, inadequately managed companies usually do not recognize their weaknesses nor realize the cause of their dilemma.

Next in importance comes the question of research and technical staff. No one small company can afford to maintain a high grade technical staff, covering all phases of engineering and management; nor can it build and maintain costly laboratories and equip them with all the modern facilities necessary for complete investigation and analysis. This activity is much more in-

portant in the early stages of a new industry than later on. Innovation, new developments, and new methods are flowing the aviation business almost daily. Those who are prepared to take advantage of this situation will emerge, in ten years from now, with flying colors; those who are not, after struggling a few years to market a generally obsolete product, will simply expire of starvation. To compare the picture, let me mention but a few recent developments which meet the closest attention on the part of everyone, but which are again beyond the scope of research of the aviation aircraft company today. (1) Diesel engines. (2) Steam wings. (3) Metal construction. (4) Parasol wings. (5) Amphibious landing gear. (6) Guarded propellers. (7) Jet engines. (8) Dirigibles. (9) Competitive costs of operating multi-engined vs single engined on a given line. (10) Comparative costs of operating engines at low speeds with independent overhead vs. high engine operation and frequent overhead. Etcetera.

At this point we must not overlook technical assistance of another sort, namely, that which has to do with administration, and that which concerns Public Relations in discussing the former, let us borrow a leaf from the book of one of aviation's largest and greatest looking companies:

"The management will emphasize the necessity for decentralized operations and responsibilities with coordinated control. Such a policy is essential in an organization comprising a large number of separate and distinct operating divisions in all branches of aviation activity, each branch being a highly specialized business in itself . . .

"Each division must be a complete organization in itself. It will be tied in to the Corporation largely through accountability only. The head of each division must assume full responsibility for the successful operation of that subsidiary, his function being, at the same time, tributary to the accomplishment of a central motive, i.e., operation for the benefit of the owners to whom the corporation owes its existence. Since it is only through service to the public that the interest of the owners is assured, this motive is not inconsistent with the broader interests of public service . . .

"The Executive Committee will be guided largely by the advice of the active executives of the company, who, in turn, will have available at all times the results of the surveys and investigations of a complete and competent staff of technical experts. Not only will laboratory research by this staff be emphasized but also there will be formed committees comprising leading executives of the various divisions comprising each separate branch of aviation activity, such as Transportation, Traffic, Air wings, Baggage, Airports, Airservices, and so like. These latter committees will serve as clearing houses and centers of information for the various divisions operating in a given sphere. In other words, not only is the Corporation aided in the accomplishment of its purpose by the cumulative assistance of all divisions, but each division, in turn, must benefit by the experience of each other division. Finally, only by means of a corporation of broad scope could

the lesser companies hope to maintain research laboratories and a technical staff. In this connection, it should be pointed out that an accurate presentation of facts greatly facilitates the agreement of many minds of different opinions. Disagreements fade away in proportion to the degree in which facts may be substantiated for reliance, and agreement is, of course, the heart of coordinated control."

THE ABOVE PARAGRAPHS read almost like an essay of Emerson's. Considerable business wisdom and broad understanding of aviation affairs exist here distilled (somehow). With this spirit of wise administration behind a group of subsidiaries, it is hard to imagine anything but the finest of morale, loyalty, and enthusiasm; and no company is ever any stronger than its personnel. Not one tiny unit, wholly independent company possibly established and maintained each branch and sustaining centers in the industry.

Regarding Public Relations, the subject is altogether too broad to allow an extended discussion here. How extensive it is to say that both state and federal agencies are not only cooperating, but also are constantly establishing new facilities; the aviation industry must be prepared to co-operate with these governmental activities to the fullest possible extent; if it expects to retain what it wants. Small, scattered, uncoordinated, and widely varying units can only hinder these departments. On the other hand, strong, constantly repeated, and obviously honest and intelligent opinion not only help but are even welcome.

As an example of what can be accomplished by a well coordinated program, let us quote from a resolution recently passed by the Western States Governor's Conference, held at Salt Lake City, Utah on Aug. 22, 1938. This conference was called following the Western States Air Commerce and Airways Conference, held at Boise, Idaho, on July 8-9-10, 1937.

Whereas, the Western States Aeronautics Association, comprising representatives of the Governors of the Western States, was organized at Boise, Idaho, July 10, 1937, for the purpose of promoting air commerce in the West and with the following objectives:

"1. Uniformity and flexibility in legislative matters.

"2. Adoption by the States of the regulations promulgated by the U. S. Department of Commerce.

"3. Establishment of State and interstate airways in close coordination with the Federal Airway system, uniform airway laws, and reciprocity between States relative to licensing of aircraft, pilots and aviation.

"Now, therefore, be it Resolved that this conference endorse and organize and its purposes and urge the active support of public officials and those engaged in the industry, and particularly request those states that have not already appeared represent themselves and associations to take immediate action by making suitable appointments."

Here there are laid the result of cooperation in the highest degree between state governments, the Aero-

nautics Branch of the Department of Commerce, the Post Office Department, the U. S. Chamber of Commerce, the Army Air Corps, the Bureau of Aeronautics of the Navy, the Aeronautical Chamber of Commerce, the National Aeronautics Association, and the industry at large. What more could one wish? Unanimity, in present confusion; flexibility, in former, unworkable action. A pretty picture that, and one which hardly will for the future prosperity of our industry.

True the associations mentioned above played a major part in the splendid accomplishment of the above Conference. However, some of the most fruitful and helpful discussions were advanced by experts loaned to the convention by large concerns. Only the big holding companies could possibly afford to retain competent staffs capable of handling such work. Above all, it is not enough the activity with old business "holding." Nor does it in any way work of these associations. In fact, every industry must protect itself against those who might misuse it, either maliciously or through plain misunderstanding. No industry can long remain healthy and robust unless industry is left entirely in the uncoordinated hands of those who are assigned to the task of regulation. Competition is the life of trade. There is plenty of it today in aviation, which means that the industry will be healthy, flexible and rapidly developed for the best interests of the general public.

LAST WE COME to the part mergers play in the efficiency of duplicated effort and in the reduction of economic waste. Every manufacturing company must have a general manager, a production superintendent, a sales manager, a purchasing agent, a chief engineer, a chief accountant, and various other highly paid individuals who are strictly "costful" personnel. These they must have whether they make one or one hundred planes per month. Overhead, in some aircraft plants, has run as high as 500 per cent of direct labor cost. Obviously, this heavy and comparatively fixed burden can be greatly reduced per plane by increasing the number of units manufactured in a given plant. There are many other savings contingent on increased production, but this example will do to bring out the point. For instance, if the production in a factory could be increased tenfold and "General Overhead" remained the same, then one of the major items of cost would be very greatly decreased per unit.

It must be strongly understood that no company, however large or small, could possibly long prosper and prosper if an inferior product were constantly forced on several of its transport subsidiaries by one of the manufacturing units under its control. However, it is almost inconceivable that such a condition could exist in the presence of good management. I believe we may safely assume that an extensive system of coordinated mail, passenger and express lines together with flying schools and taxi services must needs provide the market which will allow a manufacturing concern to increase its production, and hence reduce cost. The arguments on both sides are too numerous for citation here, but the fact still remains that coordination with a capably managed concern inevitably means elimination of duplicated effort, expense is reduced for a given product, and ultimate reduction in costs to the public, both in transportation service and hence reduction in cost. This, then, is one of the greatest advantages in merging the interests of several coordinated concerns.

We have now examined the most obvious advantages

"The Big Four"

Curtis-Wright Corporation

Curtis Aeroplane & Motor Company, Inc.
Curtis Airports Corporation
Curtis Flying Service, Inc.
Curtis Aeroplane Export Corporation
Curtis Airport Corporation
Curtis-Robinson airplane Mfg. Co.
Wright Aeronautical Corporation
Kearney Aircraft Corporation
Blair Aircraft Corporation
New York and Southern Air Lines, Inc.
New York Air Transport, Inc.

United Aircraft & Transport Company

Boring Airplane Company
Boring Air Transport
State Air Service, Inc.
Pitt & Wainwright Aircraft Corporation
Glenn Flight Corporation
Steady Aviation Corporation
Hawthorn Manufacturing Company
Hawthorn Aero-Manufacturing Co.
Stinson Aircraft Corporation

The Aviation Corporation

Universal Aviation Corporation
Colonial Airways Corporation
Peachtree Aviation Corporation
Ember-Riddle Aviation Corporation
Rosenfeld Field, Inc.
Southern Air Transport, Inc.
Interstate Air Lines, Inc.

The DuPont Aircraft Corporation

Aircraft Development Corporation
Aviation Tool Company
Berkshire Aircraft Corporation
Berkshire Aircraft Corporation
Granger Air Transport, Inc.
Lafayette Aircraft Corporation
Horse Aircraft Corporation
Parks Air College, Inc.
Ryan Aircraft Corporation

of consolidated or merged aeronautical interests, but what of the objections? There are two interesting points whose opinions and doubts on each respect, i.e., the mergers themselves, and the public. What price must either of these pay? Firstly, I can find absolutely nothing in mergers which, as a general statement, can be said to jeopardize the best interests and welfare of any party. There is, of course, exceptions which prove every rule. We must also forever contend with cheap dealing and questionable service motives. However, a similar warning applies all through the activities of this busy world of ours; it has no particular significance here.

Second, public in ownership is about the only price the merge pays, the public, whom the industry aims to serve, pays nothing yet pays its share of the reward. That is exactly as it should be.

CERTIFIED PERFORMANCE AND Safety Ratings

THE ADVERTISED PERFORMANCE data of the wide variety of commercial aircraft at present offered for sale in the United States is, in general, inaccurate. Landing speeds and roll after landing are usually understated, and top speeds, initial rates of climb, and ceiling are usually overstated. The difficulty in regard to landing speeds has been thoroughly analyzed by Elliot C. Reed in an article which appeared in the July 20 issue of *AVIATION*. In this article it was shown that of 83 airplanes 76 were credited with suspiciously low landing speeds. The situation is little better in regard to other performance characteristics. The unsatisfactory condition may be due to a number of causes.

First: There are very few test pilots in the United States who are competent to quickly, accurately and intelligently run a complete set of performance trials. The performance data on Government aircraft has long been notoriously dishonest and Government experience has shown that the average expert pilot requires thorough training usually under the supervision of an experienced engineer, before climb, speed and other performance figures or curves obtained by him, including opinions on stability, controllability, maneuverability and the like can be considered accurate and of real value. The training period usually extends over a period of six months of intensive flying, during which time the work of the endeavor test pilot is duplicated and checked in every detail by a test

see as much a part of the results of performance testing as to the determination of data.

Second: At present performance trials are run by individual manufacturers over their own courses with their own barographs, stop watches and other instruments in widely organized parts of the country under widely varying conditions. As a rule the test pilot who runs the trials is temporarily or permanently in the employ of the manufacturer concerned and may be more concerned with meeting the manufacturer's wishes and expectations than with obtaining accurate data.

Third: In some instances deliberate distortion of facts is unconsciously resorted to for advertising value.

Fourth: A general appreciation of the significance of performance data as obtained by trials does not exist. In many instances advertised figures are based on preliminary or on wind tunnel data.

Fifth: No standard procedure for conducting such trials is in use. Roll after landing, for example, is frequently advertised but rarely is the wind velocity at the time at which this roll was obtained stated. Climb rate at altitude and smoothly shown with the airplane "light" and speeds at altitudes are almost never accurately obtained. It is virtually impossible to maintain level flight at altitude without the aid of a monoplane or similar movement and it is necessary that the full speed at each specified altitude be maintained for at least, say, five minutes before accurate variations are classified. In

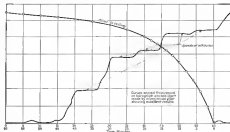


Fig. 4

case of recognized experience. Recognition and analysis of such characteristics as a tendency to auto-rotate or instability in steeping (stable in steeping position) requires, not general flying experience, but experience in that work. Invaluable opinions regarding controllability, stability, maneuverability, vibration, structure, control suitability for purpose and recommended

TRIALS

By LIEUT. COMDR. FRANK WEAD
The Aeronautical Safety Rating Company of America

In order to the airplane a series of test trials should be run to determine the speed of best climb at these altitudes, and the results should be obtained in running the smooth climb curve to ceiling. It should be unnecessary to point out that for fair comparison with other types and for a true estimate of the value of the airplane, all performance data should be obtained with the airplane loaded to its specified full gross weight, and that the same propeller setting should be used in all tests. Accurate weighing is necessary to determine the weight of gravity and tank capacity and the full gross weight should be checked before every test flight. There are several recognized methods of obtaining landing speed, of which the photogrammetric method is perhaps least subject to error.

In each of the various tests that go to make up complete performance trials, a less method exists and should be universally adopted. The conditions under which each test is to be run should be accurately defined in detail, in order that all trials may be run on the same basis, and a standard procedure should be laid out and followed. For example, it is believed that landing speeds, time and distance of take-off and roll after landing without landing should be obtained. For standard low comparison under a "no wind" condition, and the stalling speed of the engine should be noted and recorded. Little or no attempt has been made to

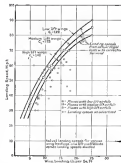


Fig. 3

standardize endurance trials. It is suggested that the endurance should be obtained in hours and in miles, at (a) full power at 15,000 ft., including climb and (b) at cruising speed at 20,000 ft., including climb, and that the maximum control should be used to greatest advantage in each instance. The full power test requires perhaps the maximum endurance for the type, and the test at cruising speed represents perhaps the maximum under average operating conditions. The average r.p.m., fuel consumption in gallons per hour and oil consumption in pounds per hour, and the average air speed meter reading

(corrected) should be recorded. The distance flown should be obtained by easily playing the chord line by the average air speed meter reading (corrected) and the cruising speed (corrected) should be decided upon after considering the air speed meter calibration curve (or speed in terms of the airplane and the fuel consumption curve of the engine as engines vary are easily very

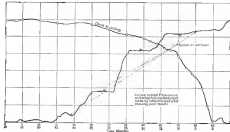


Fig. 2

troublesome details in connection with almost every item of performance testing, method of any of which would render the data obtained inaccurate or useless. Printed forms for recording observations in flight and for drawing speedograph records are of great assistance in this regard. It may also be noted that, in the interests of accuracy, the equipment and comfort of the test pilot is worthy of serious thought. Correct readings of altimeters are partly made by a pilot who is suffering from cold or lack of oxygen.

If the plan outlined above is adhered to, the final step seems to be that such trials should be run and results be furnished the manufacturer by an outside, unbiased, independent agency, having no axe to grind except the accurate, prompt and faithful dissemination of performance data and expeditious completion of the trials. Such an agency should employ highly trained, experienced test pilots of recognized ability, should utilize the best instruments and other equipment obtainable, and the work of each test unit, including that of computers and technicians, should be supervised by an aeronautical engineer.

At present there is a great variety of aircraft types in every class. These aircraft, before being placed in production, have passed the examinations of the Department of Commerce. The prospective purchaser, however, has no ready method of determining which of these types are truly high class and suitable in every way and which of them favorably meet the Department of Commerce requirements. It cannot be denied that some of the airplanes flying today have their weak points, and that others could be considerably improved in design or

structure. The Department of Commerce is primarily concerned with passing planes which present a prescribed minimum and rejecting those which do not. Safety ratings have been suggested as a means of determining the varying degrees of excellence of aircraft, such as Lloyd's ratings classify steamships.

SAFETY RATINGS should be based upon the following studies, analyses, tests or investigations: history of design; detailed specifications of the airplane; aerodynamic characteristics; stress analysis in all flight and landing conditions; static and dynamic tests of materials and assemblies, including sand loading, X-ray analyses of welds, destructive tests of fittings, drag test of clamps, etc.; investigation of loads in flight with interference and accelerometer; flight tests to determine stability, maneuverability and controllability; determination of center of gravity with various loadings; safety features; selection of materials; manufacturing facilities; workmanship; supervision and inspection. The study and procedure for determining such ratings should set forth the tests or investigations to be carried out under each of the above headings, indicating also how far stress analyses, safety factors deemed necessary, and similar information, and the summary of results should indicate recommendations tending to improve design or structure and to simplify production. Such a procedure would result in rating the aircraft as a type and the information placed should be of ascertainable value to prospective purchasers, to the manufacturer, and to insurance and finance companies handling aviation work. A frank competent viewpoint is invariably of value in engineering and production projects.

Some classification is necessary and the following is suggested. A rating of A-1 for the best type, followed in order by the ratings A-2, B-1 and B-2 within the following classes:

- Class 1: Single-engine, 3,500 lb. or under
- Class 2: multi-engine, 3,500 lb. or under
- Class 3: single-engine, 3,500 lb. or over
- Class 4: multi-engine, 3,500 lb. to 7,000 lb.
- Class 5: multi-engine, 7,000 lb. or over.

When an aircraft has been rated as a type, or performance class has been certified, a reasonably confident pilot who has flown the aircraft at the demands of the type are not altered during production, so, if changes are made, additional tests would be run to determine whether certified performance data or the safety rating should or should not remain effective.

Individual aircraft could be rated, after the investigations leading to a type rating are complete, by the maintenance of inspectors who work for the rating organization, at the manufacturer's plant who would thus mean that the standards of a safety rating are set on each and every airplane of the production program. Such individual aircraft safety ratings should not be effective for, say, more than three months. At the end of each three months period the airplane should be inspected to given out the rating plate, if the aircraft has been maintained in satisfactory condition, should be removed for another three months period or cancelled.

Any plan such as that outlined above will not entirely wipe the integrity of the organization executing it. Laboratory work, travel, and other research and tests, analyses and trials must be thoroughly carried out, and the opinions of consultants of recognized ability must be obtained when necessary.

HANDLING Personnel IN THE AIRCRAFT FACTORY

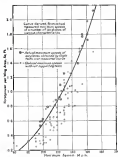
By ELWOOD D. ULLMAN, JR.

HOW TO HANDLE the hundreds of job-takers who become the airplane factory each week, how to secure the best-suited workers for the vacancies that arise and how to keep the employees in a happy, enthusiastic frame of mind so as to secure the most efficient production are among the many important problems confronting executives of the present-day airplane factory. Methods used by the Ryan Aircraft Corporation, St. Louis, makers of the six-place Ryan Monograph, have proved highly successful, and its employees are noteworthy for their high morale as well as their skill.

The plant is almost a year old, production having been started last January. It is located in the northeast portion of Lambert-St. Louis Field, one of the Municipal Airport, and consists of three buildings. There is a main factory building with dimensions of 285x75 ft., a smaller assembly plant, measuring 180x25 ft., and a two-story office building located with dimensions of 50x50 ft.

At the time this article was prepared, the personnel of the Ryan company totaled 172, of which 147 were in the factory. The number of employees is increasing as a result of accelerated production. The factory personnel, by departments, was: metal workers, 15; welders, 22; sheet-metal workers, 35; wood workers, 25; painters, 4; workers in covering and dapping department, 14; upholsterers, 4; and assemblers, 26. Apprentices, helpers and unskilled labor receive an approximate hourly wage of 50 cents. Skilled workers, such as welders, metal workers, wood workers, receive about 75 cents, and others with much experience and unusual ability are paid around \$1.

Included in the factory is a group of eight girls employed in the wing and fuselage covering department. The work does not demand the services of a skilled mechanic, so, in fact, officials have found that girls are more adept at it than men. Most of them have received



The correlation between maximum speed characteristics of airplanes and rate of climb is being determined by the U.S. Army Air Corps. The graph shows the theoretical maximum speed of an airplane assuming no drag, and the theoretical maximum speed of an airplane assuming drag. The rate of climb is plotted against the maximum speed. The curve shows that the rate of climb increases with maximum speed.



Plant assembly line at the Ryan Aircraft factory in St. Louis.

THE BENEFITS OF A Finance Service TO AVIATION

By A. O. HUNSAKER
President, Aircraft Finance Corporation of America



WHEN THE NEWS SERVICES of the Nation flashed forth the word that the first supersonic had been formed to finance aircraft manufacture in much the same way that General Motors Acceptance Corporation and other national companies finance automobiles "paper" telephone calls, wires, letters and personal visits very quickly indicated that a substantial demand existed for just such a company.

The fact, however, that in aircraft financing there were additional considerations, including financing of the manufacturer, distributor, dealer, pilot/purchaser and even, under proper circumstances, investors and passengers, brought forth a host of inquiries as to "how it works."

At the request of AVIATION, we will outline the function of a complete financial service as it affects various branches of the flying business, taking them in single steps, from the manufacturer on down.

Let us assume, then, that there exists such an organization as the Black Aircraft Company, building a plane that sells for \$15,000 that its plane is of an approved type, powered with an approved engine, and, therefore, insurable. That is the only kind of airplane that can be financed at present, in any stage of the transaction, because protection against loss of the delivered payments is essential to the sound conduct of any financial institution.

The Black Aircraft Company receives a contract from a large transportation company for six of its planes, a total cost of \$90,000. Other contracts are on hand. The company can use borrowed capital, as fact, it avoids such capital, because it cannot collect until delivery is made. Under such circumstances the manufacturer could make application for a very generous share of what the planes cost him to produce, possibly he could secure all the funds he needed for such a purpose, assuming that the financial stability of the buyer and the value of the contract were definitely fixed as worthy.

The collateral in such a loan is in an assignment of the finished planes in the leasing corporation, plus the bills of lading for ultimate collection.

IMMEDIATELY after engine manufacturers do not make their own engines and because engines cost considerable money, this might not infrequently occur some such situation as this:

John builds engines which he sells to manufacturers for \$1500. The Black Aircraft Company contracts for 1,000 of them, at aggregate cost of \$1,500,000. Both aircraft and engine builder build themselves, the sale to

dealer within a specified time, in satisfactory condition; the other to pay upon acceptance.

The builder of the engine wants \$750,000, so he can proceed. He could borrow that, on the same basis as the hypothetical plane builder in the case outlined above. The collateral would amount to the same thing. Only, in this case, upon delivery of the finished engine, the lending corporation might say to the aircraft builder, putting it freely:

"There is no necessity for you to pay cash for these engines. We will pay for them, and you now owe us \$1,500,000 plus charges. You use your money for building airplanes."

Throughout the life of the loan to the engine builder there is a likelihood that technical experts of the finance corporation would contact the plant and see that requirements were met and specifications rigidly adhered to. Men of skill might be introduced, if conditions called for it.

NEW WE ARE BACK to the Black Aircraft Company again. They have sold the 1000 engines and built 1000 airplanes and now they wish to sell them. Some have been absorbed on contract purchases, others must go to customers.

In the past it has been necessary for the distributor to pay cash over for flooring plants for display purposes. If the manufacturer could only make it possible for him to make his money go further, he would be able to show a more representative line. Here, then, is how aircraft financing renders a further service to the manufacturer. It provides him with his best selling argument, because he can offer the distributor four to five times as great a buying power for a given amount of money.

"Pay me only 20 per cent of the wholesale cost," he tells the distributor. "My financing company will handle the other 80 per cent."

Of course, in such cases the planes are understood to be for display purposes only and are not to be demonstrated, nor flown. Charges for such a service are most reasonable.

But we are getting into the distributor and dealer problems, and they had best be reserved for later.

Within the same process as the manufacturer might be said to be the parasite and creditor. The problem is possibly laid within this boundary because, after all, what he wishes to become is a manufacturer. There is a distinct place for the financing corporation in this sphere also.

The parasite, instead of wandering from pillar to post

attempting to interest someone in his patent, can wear the financing corporation's technical staff and very quickly see evidence of financial assistance, if what he has patented or invented is a practical and profitable article.

That he is saved time, energy and money, the necessity of borrowing, or becoming part of a separate company, even a selling corporation to raise money, finding markets, etc. The financing company, if it accepts his problem, does the organization and promotion work through its own staff, and its compensation is an interest in the business. In some cases it might actually, or largely, underwrite such a business. The chief difference here between how a financing corporation would handle such a case, and how it actually would be handled, is simply this: the product must stand up under the test of technical experts before anything will be done, whereas an unscrupulous promoter might accept any kind of a "patent" as a foundation for a speculative case.

And now, regarding the distributor and dealer.

Engaged in the business of merchandising very high-priced goods, his position might be said to be analogous to that of a Cadillac, Lincoln or Buick-Royce distributor and dealer who has to pay cash to floor his cars. One can imagine how sparse the display rooms on Automobile Row would look if such were actually the case. And one can understand, at the same time, why most distributors and dealers of airplanes show such an unrepresentative line of whatever craft they happen to represent.

THE ADVANTAGE of financing the distributor and dealer in the aviation world is just as important, if not more so than in the car world, and at the same time profitable, business of financing the automobile man. A very acceptable plan has been worked out in behalf of these "middle-men."

Inasmuch as the financing process is largely a link between manufacturer, distributor, dealer and final purchaser, the "approach" is to the distributor and dealer in general through the manufacturer, whose products he represents. However, that is not vital, the distributor can act for himself directly, if he chooses. In either case, the machinery is the same.

Various agreements affect the working arrangement, as between the finance company and the manufacturer, as between the finance company and the distributor, as between manufacturer and distributor, and so on. But it all centers down to this:

John Jones has the distributorship in a given territory

of a certain manufacturer's airplanes. Various models are produced, but Jones cannot afford to keep more than two on hand, because he must pay cash, and heeds the timely necessity to place a complete stock on his floor.

Through financing arrangements he can spread his cash farthest further than it actually would go, for only 20 per cent is required for a 90-day financing at a straight legal rate of interest plus a very small load charge for book-keeping. With \$25,000, therefore, Jones can keep on hand about \$100,000 worth of stock.

The first requirement, naturally, is the establishment of a wholesale line of credit by the distributor as dealer. A financial statement must be filed. Assuming the granting of the credit, the business then proceeds under the two of the state in which operations are being carried on—either under conditional sales contract, or chattel mortgage form.

The three month's financing privilege may be extended as additional period of time upon request, and the down payment of the distributor covers extras, freight, handling, docking advances, etc. Interest charges cover, in addition to interest, conversion charges, bank fees and exchange charges.

Obviously, it is not necessary in the case of the dealer and the distributor, so long as with increasing the away risks that would be included with the draft to be used in demonstrations. For display purposes only, fire insurance is sufficient, but it is understood that the dealer or distributor will not take the place off the ground during the life of its contract, or lose, without insur-

fairly and in advance, notifying the financing corporation.

If the manufacturer can extend credit terms to the distributor, the distributor can extend them to the dealer. By the same token, the dealer can carry the hypothesis to another way to the pilot purchasing the plane.

The worst layman can appreciate what such a service will mean to the progress of aviation. Manufacturers can rest assured of a greater absorption power through distributors and dealers, and the psychological effect of many airplanes on display, instead of the usual small sales, will greatly influence a growing sales.

There have been a good many arguments during the past few years as to the wisdom of installment purchasing; of continuing to pay for something in the future that cannot be paid for out of pocket today. But the over-popularity of America would seem to belie the alleged dangers of buying on such a basis. Economists may argue that this is a land rich in natural resources and would be prosperous, anyway. They may argue that we are a naturally energetic, go-getting nation, or that the war debts of other nations are piling up gold on our shores.

But the fact remains that other nations are energetic; that others have great natural resources; that others have enormous collections coming in from foreign sales. About the only factor not common to almost all industrial nations, developed to its ultimate only in the United States.

Here are 26,000,000 automobiles, against thirty thousands in other lands, but our women are released from household by washing machines, vacuum cleaners, and electric refrigerators doing the "dollar down" business, and interned by radios purchased the same way. Luxuries remain luxuries where installment purchasing is not the rule, and become part of our daily lives, where they are.

At the same time, everything is capital, and we own more when we can pay for a gradually than we would ever own if we had to pay for it all at once.

THE PURCHASE OF AIRPLANES for purely sports purposes is not much greater and greater popular. Most of the sports flyers want good planes. They appreciate that as business or professional men they are in a position to keep as thoroughly in practice as regular flying pilots, and they like to know that the machine they are flying is right. But for every one that can pay \$15,000 cash for such a plane, there are thousands that can pay \$3,000 in cash and the balance over a period of time.

Must we hold back producers until these men have accumulated the cash, and until we lend these men from developing a broader flying spirit? Finance corporations are organized to make it possible for the manufacturer to build more planes with safety of sale; for the dealer and distributor to stock more planes with a great amount of money; for the finance pilot-purchaser to buy on terms. And such a service, perfected here in the United States, will go far toward paying aircraft in our skies and making this nation the most air-minded in the world, and the best protected in an emergency.

It has only been within a comparatively recent period that financing of this type was possible. Insurance rates had to be worked out on a basis that did not make for profitable costs; there had to be some official recognition of loan rights so that both buyer and seller would know just where they stood in the transaction. But this

is an adaptable country, and both these obstacles have been wholly or partially cleared away.

When a man buys an airplane, now, on the installment basis, the financing company rendering a service which makes such purchase possible, is protected against loss on deferred payments not only through prior liens on the purchased plane, but also by cash, fire, wind-storms, tornado, collision, and vandalism and theft insurance of a single interest type. And the cost is financed right along with the cash.

That cost is no longer prohibitive. It can be as low as 65 per cent of the deferred balance. A \$10,000 plane, for instance, on which the buyer had paid down \$3,000, could be insured in favor of the financing company for approximately \$300, insuring the risks outlined above.

BETTER SERVICE is only one aspect of aviation, only one point in the picture where installment buying will make it easier for purchasers. There are consequently insured planes to be considered: more doctors, possibly, of transporting short-run loans in territory not now served by regular schedules. There are the transportation companies themselves who might want to add to their equipment without having to turn to cash capital on hand which might be required for other immediate needs—a sort of equipment-first service. Aerial police services; aircraft doctors; airplane agronomists; schools—these and many others need financial assistance at one time or another.

Then there is another side to aircraft financing beside that of the manufacturer, distributor, dealer and pilot-purchaser, although there are certainly the most important. Aviation has many institutions which call for high cost outlays of cash. The buying of properties for airports, the installment purchase of engines to replace worn-out power plants, financing repair jobs on several planes at a time; the cost of handling of which might be beyond the ordinary means of the very shop; and the underwriting of installment paper in connection with aviation supply house sales. These are but a suggestion of what such a service can be, and how broad its scope.

Probably few men in aviation are not aware of the fact that the Aeronautics Division of Commerce, in conjunction with the Aeronautics Branch of the Department of Commerce, and with finance and insurance experts, has worked out a plan feasible for its recommendation for application to installment purchases of aircraft. That plan makes it no longer compulsory for the pilot to show a full of ownership; it may be ownership subject to lien. It also removes from the financing corporation, eligibility for the sale of the pilot. And there can be no return of foreign capital to set up dummy companies for coming control through other than legitimate financial channels. That is sound protection for both the buyer and the seller.

Whether a pilot used to be unable to have his plane repaired in his name, or licensed on his behalf, unless he covered the plane outside, he can now show such registration with the Department of Commerce, with the sole exception that "Subject to Lien" is rubberstamped across the face of the license card.

So one need not be anxious to buy an airplane. All that is required is a small down payment. The balance may be paid over a period of six months, ten months, or even a year. The finance company is ready to make all the arrangements. The prompt rules of interest are reasonable; insurance is no longer a burdensome loading large in dollars.



By J. DUN ALEXANDER

President, Alexander Aircraft Co.

High Speed AS A SAFETY FACTOR IN THE AIRPLANE

FEW PEOPLE realize the advantages of airplane speed from a safety as well as an economy standpoint. Providing no large sacrifice is made in building speed, structural strength or maneuverability, the fastest plane is the safest plane. It spends little time over rough terrain on a long cross country flight, minimizes the possibility of a difficult landing in event of motor trouble. Less time is spent in the air fact multiplying against the menace of storms. On a 1,200-mile flight across country an airplane may coast on hitting a bit of rough weather. If a faster plane encounters the same distress in half the time, its pilot may half the risk of hitting the elements. The may dodge around storms easily and reach his destination, whereas the pilot of the slow plane, confronted by dark thunderheads, would probably land and call it a day. In his case the delay of the slower make further flight impractical.

The faster an airplane, per horsepower, the more economical it is to buy and operate. A plane with low drag and resistance, and economically speedy, does not require an expensive, high powered engine in order to reach a high top speed. A light, streamlined engine, costing less time to buy and run, will suffice. Consequently the "low drag" type of plane is certainly the more economical.

The carefully streamlined plane, with little or no exposed parts slips through the air like a hurricane through the sea and requires little horsepower to maintain a fast cruising speed. Unless the pilot is in an unusual hurry, he may throttle down his engine and save gasoline as well as wear and depreciation on his engine.

Excess speed in an automobile is an indication of economy. In an airplane it is. The faster an airplane per horsepower of its engine, the less costly it is to fly. Not only does the faster plane save the time of its passengers, but it covers more ground at less fuel costs and less depreciation on the engine.

GREATEST SPEED per engine horsepower is gained only by reducing drag or parasite resistance and by reducing weight. These are the limiting factors to an airplane's speed. As the speed increases, the drag and resistance increases. Achieve the impossible and eliminate all drag and resistance, and there would be no limit to the speed of a plane. Under the circumstances the best we can do is to minimize these factors as much as possible.

The chief advantages of the light, low powered engine, of course, lies on its low initial cost and low cost of



The Alexander "Bulfinch" low wing monoplane, with retractable landing gear.

FOREIGN ACTIVITIES



R. 101 Rides Gale At Mat Successfully

By Airline Staff Correspondent

The British Sea antler, R 100, formerly a mailer, a record day for the sea came out of the shelf the worst weather encountered for years. The aircraft was flown over the sea and the weather was particularly bad. The aircraft was flown over the sea and the weather was particularly bad. The aircraft was flown over the sea and the weather was particularly bad.

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	Altitude	Speed	Time
First flight	20,000 ft.	100 m.p.h.	1 hr. 15 min.
Second flight	20,000 ft.	100 m.p.h.	1 hr. 15 min.

A wind of over 75 miles is counted as of hurricane force to R 101 actually withstood the operation of a hurricane at the highest level. The aircraft was flown over the sea and the weather was particularly bad. The aircraft was flown over the sea and the weather was particularly bad.

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P.A.A. to Build Panama Hangers PANAMA CITY (PANAMA)—Pan American Airways has obtained permission from the Panamanian government to build hangers at the Pacific Base Airport here and at Dorado.

Lioré-et-Olivier Firm Builds New Flying Boat

PARIS (FRANCE)—The Lioré-et-Olivier firm produced recently an interesting little machine flying fast enough for touring or school work. The machine was turned out, also, to serve as a light machine to obtain data for the construction of a much larger commercial plane on the same line.

Several novel features distinguish this little machine, which is of orthodox all-wood construction, with fabric covering. The power unit is a Sabson 130 hp. inverted star engine, driving a propeller assembly, and mounted above the full mainline wing, which runs directly on the top of the fuselage. The propeller is driven through a shaft with connecting flexible couplings incorporating Japanese Sinterflexes. Six quick detachable floats serve the whole unit. Fuel tanks are placed inside the wings.

The closed cabin is strong enough to contain five side-by-side seats, a third seat and baggage space. A special landing gear is provided for use of the machine in a land plane. In fact, the first flight, now made with the floats in place.

The machine is a small machine, but it is very strong, and it is very fast. It is a very strong machine, and it is very fast. It is a very strong machine, and it is very fast.

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Conference on Aviation Law Meets at Warsaw

WARSAW (POLAND)—Plempelstein, acting down twelve nations have agreed the convention regarding aerial transport which was accepted by the second international conference on aviation law, meeting here Oct. 4. This conference was held to consider the recommendations of the International Committee of Technical Experts in Aviation Law, formed at the suggestion of the French government after the first conference on this subject, which was held in Paris in 1925. The committee has been active since that time.

After the election of M. Lecomte, dean of the Polish faculty of law and head of the Polish delegation, as president, and the election of honorary vice-presidents, the conference proceeded to the business of the session. Thirty-two nations were represented, although delegates plenipotentiary were present from only about twenty. The draft of an international convention which had been prepared in advance was not found to be entirely satisfactory, but a special committee succeeded in modifying it satisfactorily within a short time, and it was then adopted, under the title of convention on the carriage of persons, goods, mail and baggage by air.

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Are you contemplating the purchase of a single-engined cabin plane for 1930?

Consider the Official Results of the Fifth Annual Ford Reliability Tour!

COMPRESSED OFFICIAL RESULTS OF 1929 NATIONAL AIR TOUR

Single-engined Cabin Planes Only

Planes and Pilots	States of Plane Ownership	Building Company	Pilot	Miles of Flight	D. A. C.									
					Time Total	Time Lost	Time Idle	Time Flying	Time Waiting	Time of Flight	Time of Flight	Time of Flight	Time of Flight	Time of Flight
5th Bellanca	6	Capt. Geo. Haldeman	Weight 2-5 340 h.p.	4,600	2,310	0.11	11.5	101.56	1,041.58	132.4	33,277.40			
6th Bellanca	6	R. A. Nye	Weight 2-5 340 h.p.	4,075	2,795	0.8	8.7	145.51	1,022.64	128.6	31,892.22			
8th Bellanca	6	Stanley Sorenson	Weight 2-5 340 h.p.	3,000	1,229	7.1	9.7	145.51	893.70	131.7	32,779.46			
12th Bellanca	6	Dale Jackson	Weight 2-5 340 h.p.	3,000	1,544	2.3	9.8	115.88	865.68	118.6	32,699.20			
13th Bellanca	6	Earl Bechtel	Weight 2-5 340 h.p.	3,100	1,605	5.8	12.6	138.48	1,267.75	144.4	32,644.36			
14th Bellanca	6	Steve Lacey	Weight 2-5 340 h.p.	3,100	1,218	8.5	7.0	152.15	879.34	130.2	32,038.36			
15th Bellanca	6	Richard Piers	Weight 2-5 340 h.p.	3,100	1,570	6.9	12.7	130.06	755.08	139.4	31,564.02			
17th Bellanca	6	Wiley Rose	Weight 2-5 340 h.p.	3,100	1,575	11.8	10.4	100.15	665.91	115.4	31,077.39			
18th Bellanca	6	J. L. McGrady	Weight 2-5 340 h.p.	3,100	1,500	11.6	10.3	120.12	738.16	133.9	30,271.35			
19th Bellanca	6	Ronald Young	Weight 2-5 340 h.p.	3,100	1,299	10.7	11.1	138.80	679.34	139.6	30,099.40			
22nd Bellanca	6	Gentry Shallen	Weight 2-5 340 h.p.	2,600	940	8.2	9.3	100.50	597.00	108.0	31,267.99			
31st Bellanca	6	Norman Wilcox	Weight 2-5 340 h.p.	4,215	1,468	12.1	11.3	125.76	553.48	130.1	31,790.77			

*Average speed made good is calculated on time elapsed from start to finish.

THE figure of merit for each contestant in the Ford Reliability Tour was determined on the formula:

$$\frac{\text{Maximum Dept. of Commerce}}{\text{USEFUL LOAD}} \times \frac{\text{maximum speed}}{\text{Useful} \div \frac{1}{2} \text{ tank}}$$

which, translated into English, means that an airplane will have the highest merit points which will—

take the heaviest load in and out of the smallest field
—will fly the fastest with that load—and will do
all this with the least horse-power!

Study the Official Results printed above, and you will see that compared with all other single-engined cabin planes the BELLANCA is 32% to 146% more efficient. That means the BELLANCA airplane cabin monoplane, the Pacesetter, can carry its amazingly heavy load at a lower cost than any other cabin airplane represented.

We have completed an analysis of the tour, with particular reference to single-engined cabin planes, copy of which will be mailed anywhere in the world upon receipt of written or wired request.

Bellanca Aircraft Corporation
New Castle, Delaware, U. S. A.
Cable address: Bellanca

AVIATION
December 7, 1929

The Bellanca victory of the Cleveland Race was repeated by that of the Ford Tour. In the official tests made at Detroit, the BELLANCA Pacesetter carried its full useful load of 1,507 lbs., with a speed of 143 7/8 m.p.h., a take-off of 9 seconds, and a landing of 6 1/2 seconds. Carrying 3,310 lbs., useful load, equivalent to full load and 75% people, the BELLANCA Pacesetter (a stock model Pacesetter with large freight or mail compartment) showed an speed 142 98 m.p.h., take-off of 11 1/2 seconds and landing of 9 1/2 seconds. And at that, these Bellanca tests were run at the last moment in a dead calm, though a wind of 6 to 10 m.p.h. had favored the other contestants.

And then . . . over the entire tour, a grueling trial of about 2,000 miles, the official results show Bellanca taking the three highest totals of the contest regardless of type . . . two Bellanca monoplane for ahead of all other single-engined cabin planes, in which also they finished first and second . . . two Bellanca the only single-engined cabin planes among the first ten "in the money" . . . 4,000 miles of competitive touring at an average speed of 132 4 m.p.h.

Does either the BELLANCA Pacesetter or the 300 h.p. Wright Whirlwind Nine Engine need any further demonstration in proof of leadership?



BELLANCA.

AIRCRAFT ENGINE PARTS



PARTIAL LIST OF PARTS

Piston Pins • Wrist Pins • Link Pins • Cam Rollers • Cam Followers • Tappet Guides • Valve Guides • Spacers • Thrust Washers • Dowel Pins • Valve Seats • Special Bolts and Screws • Milled Thread Studs • Valve Stem Collars • Cylinder Seats • Crankcase Studs • Propeller Hub Cones • Propeller Hub Nuts • Tachometer Drive Shafts • Auxiliary Drive Shafts • Cylinder Barrels • Crank Cases • Pistons

All Parts Made to Manufacturers' Specifications

1225 Oakman Boulevard
Detroit

EX-CELL-O
Aircraft (X & L) & Tool
Corporation

The PARKS TRAINER



STANDARD TRAINING PLANE AT AMERICA'S LARGEST AIR COLLEGE

Standard training plane at the Parks Air College—largest and finest in America—the Parks Trainer is now available to independent flying school operators and to all sportsmen. Especially adapted to student instruction—ideally designed for private pilots—it is the foremost plane of its class on the market today.

Back by a division of the Detroit Aircraft Corporation, the Parks Trainer is backed by an organization which holds a position of recognized leadership in the industry. In design and performance it is recognized today as the most satisfactory type of training and sport plane.

Such outstanding features as inherent stability and amazing maneuverability—exceedingly low landing speed and 90 m. p. h. cruising speed—together with positive flight control are a few of the many superlatives of the Parks Trainer.

The Parks Trainer—equipped with an OX-5 engine—is priced at \$3,165. For greater horsepower requirements, the Parks is offered with an Anzoni 150 h. p. engine at \$5,000 and with a Wright J-6, 165 h. p. at \$6,350. Our illustrated folder containing complete details will gladly be sent upon request.

PARKS

PARKS AIRCRAFT CORPORATION

Detroit, Michigan

DETROIT AIRCRAFT CORPORATION

Union Trust Building, Detroit

Building a hangar? Planning an airfield? Facing any airport problem?

Come
to

ROBERTSON



A model hangar at Minneapolis in which Robinsons actually were used.

LET'S not make any unavoidable mistakes. There is so much yet to be done in this aviation industry . . . so many claims upon every penny of available capital . . . that none of us is justified in repeating experiments that have already failed, or in making mistakes that cost money.

Take hangars, for instance. So many things have already been proven about them that there is no need to make costly experiments. There is no use, for example, to take a chance on unprotected metal roofing or siding for hangars. Do what you will, they will rust away.

There is no use, on the other hand, to sink thousands of dollars into "heavy construction." It costs too much, and moreover it is a dead loss if ever you want to make any changes in

your field. For another thing, there is no use ignoring the need for natural daylighting in hangars.

These and hundreds of other problems have been met and solved. The Robertson engineers have participated in all manner of trials and experiments in hangar construction all over the world since before the birth of modern commercial aviation. They know the answers to most of the questions. Let them look over your plans. Their suggestions will cost you nothing and will not obligate you. Just send your blueprints or plans to

IN H. ROBERTSON CO., PITTSBURGH

ROBERTSON



ROBERTSON
Has the
Experience



I FOUND THAT OUT
THE FIRST HOP
I MADE WITH
QUAKER STATE!

THAT EXTRA QUART
IN EVERY GALLON
MEANS A LOT!



GET her Quaker State Aero Oil, then give her the gun—and you, too, will find that the extra quart in every gallon means a lot!

And what do we mean by an extra quart in every gallon of Quaker State? Just this . . .

Ordinary refining leaves in every gallon of oil, a quart or more of material that has little or no value in lubricating an airplane motor—a quart of waste.

But Quaker State Aero Oil is not refined in the ordinary way. It is *super-refined*—carried a step further. And this "extra step" removes the quart of waste that ordinary refining leaves in. In its place you get a quart of lubricant—you get an extra quart in every gallon of Quaker State!

And all four quarts are made from the very finest grade of oil that the world produces . . . 100% pure Pennsylvania Grade Crude . . . the value of which is two or three times that of the crudes from which ordinary oils are made!

Let Quaker State itself prove the difference! Ask for it at your airport, let your motor have it . . . then sit back and enjoy the smoothest, sweetest lubrication you ever found for an airplane motor! Quaker State is sold everywhere—there are over 600 Quaker State distributing warehouses and more than 80,000 Quaker State dealers in the United States and Canada to serve you!

QUAKER STATE AERO OIL


QUAKER STATE OIL REFINING COMPANY

Oil City, Pa.



Order Pure Pennsylvania Products Here:
QUAKER STATE MEDIUM MOTOR OIL • QUAKER STATE COLD TEST
QUAKER STATE HEAVY MOTOR OIL • QUAKER STATE TRACER OIL





EASTMAN FLYING BOATS equipped with HEYWOOD STARTER

—and now the well known "Eastman Division" of the Detroit Aircraft Corporation is equipping their flying boats with Heywood Starters.

Rapidly this starter is becoming the accepted standard equipment unit of the aircraft industry. How about your product? Should it not also be equipped with this advanced injection starter?

For the Heywood Starter starts instantaneously. The Heywood Starter has few moving parts. The Heywood Starter is a marvel of simplicity — both in operation and design. The Heywood Starter is light — dependable — and at all times certain.

Send for complete descriptive matter today.
SKY SPECIALTIES CORPORATION
Detroit, Michigan
3611 Huron Avenue



START-ER
BY
HEYWOOD



PILOTS SAT ON THE LEADING EDGE



WHEN U. S.

BUILT THE FIRST PNEUMATIC AIRPLANE TIRES



Back in the early days when flying was young—when biplane pioneers glided their flimsy planes from unprotected seats perched on the leading edge of the lower wing—when flying and flying were regarded ardently by few—high when the United States Rubber Company first built pneumatic airplane tires and offered them to the infant industry.

Planes were lighter then and speeds far lower than today's. But then, as now, ground safety depended on the durability and strength of tires. And as requirements grew more exacting—as planes grew heavier and greater speeds were

attained—the U. S. Rubber Company continued its pioneer in the development of airplane tires.

More than 60 years of research and development are behind the modern U. S. airplane tire. There is a complete range of sizes with either plain or non-skid treads. And every tire is the best of web-cord construction—an exclusive U. S. development which guarantees maximum strength without excessive weight. U. S. Branches are prepared to give immediate service to manufacturers and users everywhere.

UNITED STATES RUBBER COMPANY

Standard six-place biplane
equipped with United States tires



UNITED STATES
AIRPLANE
TIRES



KEYSTONE-LOENING AMPHIBIAN "AIR YACHT"



A ROBIN HELPS FIGHT a Minnesota Forest Fire

Out of the North . . . another story of how the Robin
"comes through"
in an
emergency

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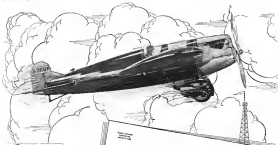
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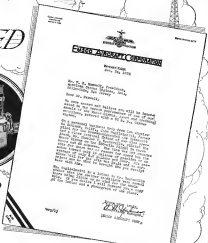


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